To be presented by
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On January 27 of this year I said that in my opinion it was imperative, for the peace and welfare of the world, that the United States should lead in the exploration of space, and that the goal of our national space program should be the development of manned satellites, and the travel of man to the moon and the nearby planets. In the months since then, it has become apparent that the course we will need to follow as we move into space is quite clear and straightforward.

As a matter of fact, the extent of our penetration into space in the next few years, using both instrumented and man-carrying craft, will depend in large measure upon how effectively we utilize knowledge already in hand, and upon how hard we work to reach the far-flung goals we have set. Except for the enormous progress made in the past 55 years toward solution of the problems of flight, we would be but little closer to the exploration of space than the dreamers of early times.

The basic components of the first successful airplane, the one Wilbur and Orville Wright flew in 1903, were the structure, the power plant, and the control system. These same components are with us today, in both manned and unmanned vehicles. They will be the basic components in tomorrow's space craft.

Any flight vehicle, no matter how many thousands of miles an hour it attains or how far into space it travels, has to start from earth and accelerate from zero speed. It will have to traverse the transonic and supersonic ranges. Its early flight will be within the atmosphere. Similarly, on its return to earth from a space flight, any vehicle will have to decelerate on re-entering the atmosphere and land at low speed.

Of course, space flight requirements impose new and very difficult demands upon our technology, but what is mainly required is raising to new, very high levels, our competence in propulsion, structures, and guidance and control. It may be over-simplification, but not over-statement, to say that what we must do to move into space compares to the technological advances which made possible the past transitions from wood-and-fabric to all-metal airplanes, from reciprocating engines to turbojet engines, from subsonic to supersonic speeds, and from low-level to high-altitude, pressurized flight. Each of these remarkable gains in flight performance became possible because of the contributions by many men, working in many scientific and engineering disciplines.

The Congress is now considering legislation creating a National Aeronautics and Space Administration, with prospects for early adoption. The House passed the bill establishing the NASA, on June 2, and the Senate is expected to take similar action in the near future. This legislation follows closely the recommendations of the President, made April 2, that both aeronautical and space science activities sponsored by the United States, except for those projects peculiar to or primarily associated with military systems and operations, be conducted under the direction of a new civilian agency built around the nucleus of the present National Advisory Committee for Aeronautics.

Since the end of World War II, the NACA has been engaged increasingly in research applicable to the problems of space flight, and has designed and constructed the special aerodynamic, structural, and propulsion facilities required for this work. Examples are high velocity guns and ballistic ranges, atmospheric entry simulators, arc wind tunnels and other high temperature facilities, rocket facilities for research on high energy fuels, etc. At the present time, nearly 50 per cent of the NACA's basic and applied research is applied in these problem areas, directly applicable to space flight.

In 1952, the NACA formally initiated studies of, and I quote, "the problems associated with manned and unmanned flight at altitudes from 50 miles up and at speeds from Mach number 10 to the velocity of escape from the earth's gravity." This work led to the design of new facilities, free flight rocket and wind tunnel research, and to the X-15 research airplane project, a cooperative undertaking of the NACA, Air Force and

Navy. North American is now building the airframe and Reaction Motors the rocket engine, and the X-15 is scheduled to make its first powered flights early next year.

The X-15 was not and is not described as a man-in-space project, although the Secretary of the Air Force, the Honorable James H. Douglas, has said the airplane will be capable of exceeding a mile a second in speed -- more than 3600 mph. -- and 100 miles in altitude. The X-15 is a research tool designed especially for exploration of certain problems that will have to be solved before we can undertake manned flight into nearby space, with good expectations of bringing the pilot back alive. These problems include the control of the attitude of the vehicle in space in the absence of aerodynamic forces, the safe return from space to the atmosphere without destructive heating, and the effect of weightlessness on the pilots for periods measured in minutes rather than seconds. Under some flight conditions, the surfaces of the X-15 will glow at red heat. I should like to emphasize what I said earlier; space flight requirements will impose new and very difficult demands upon our technology.

The NACA is also engaged in studies of satellite configurations suitable for safe re-entry at still higher speeds, for manned and unmanned flight. This work is an extension of studies on the problem of aerodynamic heating, first faced in connection with bringing long-range ballistic missiles back through the atmosphere to the target. When you consider that an ICBM is traveling at something like 15,000 mph. when it begins its descent back into the atmosphere, it isn't difficult to understand why people say it "wants to act like a meteor." The air friction can produce temperatures measured in thousands of degrees, as hot or hotter than the surface of the sun. The earth is constantly being bombarded by meteorites, big and little. What keeps all but a very few of them from hitting the earth is that they are burned up by this process of aerodynamic heating.

In 1952, one of NACA's research scientists, H. Julian Allen, developed a concept of how to shape the warhead of a ballistic missile so that the problem of aerodynamic heating could be solved. The concept, and what it accomplishes, are in one sense very simple. Until Allen's concept was proven, it was common design practice to give the warhead of a ballistic missile a needle nose to produce minimum drag. This procedure was natural enough because missile designers usually were airplane people whose objective always was to seek a minimum-drag shape.

Allen reasoned that, instead of designing the warhead in pointed fashion, it would be better to give it a very blunt shape. The result would be creation of a large pressure drag, as distinguished from friction drag. Much of the heat -- as much as 99 per cent -- would be dissipated into the atmosphere by a great shock wave instead of being absorbed into the structure. Allen's concept has long since been proved valid; today every American ballistic missile, with intermediate and intercontinental range, incorporates a warhead designed in accordance with Allen's findings.

The same principles will have to be applied to make possible safe return to earth of the man-carrying satellites and space vehicles of tomorrow. There is, however, the further complication that man-carrying craft cannot be decelerated so rapidly as an ICBM warhead; the pilot couldn't stand the resulting "g" forces.

For the future, we see the need for new types of engines -- nuclear-powered rockets, ion jets, and perhaps others. Nuclear energy also will be used for internal power sources of the far-ranging space craft. To develop these to a state of usefulness will require large effort, and years to accomplish. There is, however, no need for us to wait for the new engines. Our "conventional" rocket engines can be enlarged very substantially, and a rocket engine with a million pounds of thrust can be most quickly attained by use of a cluster of rockets, each producing several hundred thousand pounds. Nevertheless, development of the larger engine should be undertaken promptly.

To sum up, there are many problems common to aeronautics and astronautics, particularly those arising within the atmosphere on take-off and during re-entry and recovery. There will be many other problems, some new and some old, such as guidance, communication, and power sources.

No existing agency has within it all the skills and resources needed. There are no experienced astronautical engineers. Fortunately, there are scientists and engineers experienced in rocketry, aerodynamics, guidance, communications, structures, and human factors. These are men who will have to solve our space flight problems.

NACA was selected as a good foundation on which to build, because of its staff, experienced in many of the requisite fields, and of its 350-million-dollar facilities supporting work in those fields. It would be possible for the NASA to establish new research centers for study of problems in other areas. Such a procedure would be very costly. Trained people to accomplish the work would have to be recruited and organized into a useful staff. Almost certainly, they would have to come from scientific and engineering organizations already engaged in work of importance to the national interest. Even more critical would be the passage of months and years before the new laboratories could begin producing information vital to the space programs.

A far wiser course, I believe, will be for NASA to make effective use, on a contract basis, of teams of experts and laboratory facilities already in being. To be sure, some new research facilities will be needed by NASA at NACA's existing laboratories and at new laboratories. But most of the expanded activity of NASA will be accomplished through a greatly expanded research program to obtain assistance from groups with special competence in specific areas. Thus, special talents, experienced staffs, and facilities of existing organizations can be pooled for the accelerated effort that is required.

NASA will have to develop new space vehicles. It would be possible for NASA to build the organization and the facilities for such space vehicle design and construction. But again, such action would be very costly and much additional time would be required. It is preferable that design and construction of these space vehicles be performed, on a contract basis, at existing facilities.

I am sure that our aircraft industry is more than casually interested in who may be asked to build the space craft and rocket motors for the civilian programs of space exploration and exploitation. One obvious answer is that the organizations best qualified will get the jobs. I would make the further observation than when changing military requirements called for production of ballistic and other missiles to supplement the capabilities of the bomber, the aircraft industry demonstrated that its design and production teams were singularly qualified to develop and build missiles. So long as the technical and production competence of the aircraft industry can keep up with the exploding needs of the national space program, the same reasons that discourage construction of new laboratories and scientific teams to perform work that can be done by in-being research organizations will apply to space craft development and construction.

The space programs we will be proposing soon for NASA accomplishment are three-fold in scope. There must be adequate research effort on space technology problems. There must be development and use of unmanned vehicles capable of carrying the desired scientific data-gathering apparatus. Finally, there must be the development and orderly use of man-carrying vehicles in the exploration of our solar system. The three parts of our program must be skillfully integrated and coordinated. Just as rapidly as research can provide the necessary information, we should use it in developing -- and launching -- both automated and manned vehicles with greater performance and sophistication.

I should like to emphasize the essentiality of our planning a space program that will be adequate to our needs as a nation. The size of the program and the vigor with which it is carried out must be firmly established and ratified by the Administration, the Congress, and finally, the American people. In making these decisions, we must keep in mind that today Soviet Russia is working harder than we are to achieve pre-eminence in the conquest of space.

In conclusion I should like to quote Jimmie Doolittle, Chairman of the NACA, before the Special Committee on Space and Astronautics of the Senate, last month:

"The question will inevitably and properly arise, what good will all this new information (from space) be to the people of the United States? After all, they have to pay the bill, and it is a bill that annually, for years to come, probably will be counted in the hundreds of millions of dollars. I don't know all the good it will do and I doubt if any man alive today can give specific answers. But, in this connection, I am reminded of the story they tell about Michael Faraday, the English physicist, whose pioneering work in electro-magetics had a profound effect upon our later understanding of electro-dynamics leading to useful electric power. About a hundred years ago, Mr. Faraday is supposed to have been asked, in the British Parliament, about the value of his electro-magnetic experiements. His answer, so the story goes, was, 'I can't tell you what it'll be good for. But I'll tell you this: one of these days you'll be taxing it.'

"I can't tell you precisely what of great value will come out of our moving into space to prove the secrets of the universe. However, I have the conviction, and in this I find myself in the company of some very wise men, that a century from now, perhaps much sooner, people will say that this venturing into space that we're planning now was one of the most practical, intelligent investments of our national wealth to be found in history. If we, in the United States, take the wisely bold action necessary to lead in exploiting the possibilities of space technolgoy for science, all mankind will benefit. If Russia wins dominance in this completely new area; well, I think the consequences are airly plain--probable Soviet world domination."

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